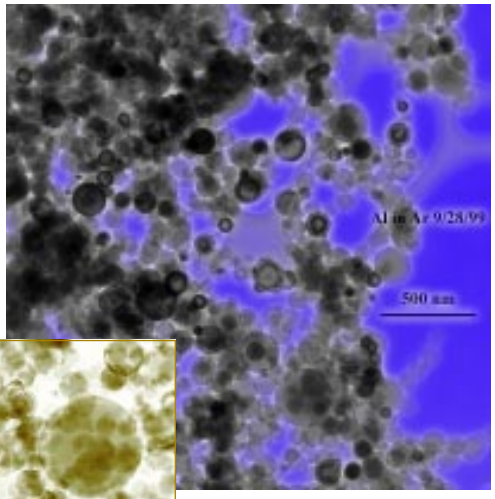
Electroexploded Metal Nanoparticles

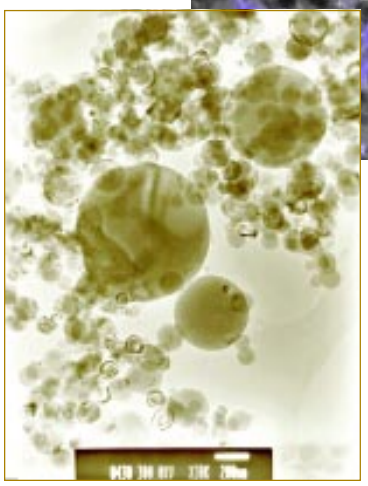
2000 WINNER

Argonide Corporation, Los Alamos National Laboratory, International Proliferation Prevention Project, National Renewable Energy Laboratory, and Republican Engineering Technical Center

The electroexploded metal nanoparticle technology will provide the market with a broad range of nanoscale metal powders from any metal or alloy that can be fabricated into a wire. The process is especially applicable to highly reactive and refractory metals that, at present, are not available by other techniques. The nanoparticles are created by exploding the wire with a huge electrical pulse and propelling the resulting metal clusters at supersonic speed through cold argon or other gases. Electroexploded metal nanoparticles are from 10 to 500 times smaller than previously available, ultrafine, metal powders, so their surface area per volume—hence reactivity—is much greater.



Al in Ar with color added.



High resolution transmission electron micrographs (HRTEM) of Argonide ALEX powder. The top photo shows a 500 nm marker and the photo at left shows a 200 nm marker.

Applications

These ultrafine-grained metal powders are used for

- enhancing combustion for rocket fuels;
- improving lubricants;
- improving catalysts;
- improving batteries;
- "writing" microelectronic circuits with nanoparticle "inks";
- enhancing explosives; and
- forming coatings for wear resistance, corrosion resistance, or conductivity.

Electroexplosion of wires produces clusters that condense to the nanopowders.

Benefits

Among the benefits provided by the electroexploding technology are

- a broad-range of nanoscale metal powders;
- greater surface energy;
- the capability to rapidly produce large quantities at a low cost; and
- the potential for new applications.

Availability of applications for commercial licensing

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